Napa-Sonoma Valley, Sonoma Valley Subbasin

Groundwater Basin Number: 2-2.02

County: Sonoma

Surface Area: 44,650 acres (70 square miles)

Basin Boundaries and Hydrology

The Sonoma Valley groundwater sub-basin occupies a northwest trending structural depression in the Coast Ranges immediately north of San Pablo Bay. The sub-basin is bounded on the west by the Sonoma Mountains. It is bounded on the east by the Mayacmas Mountains. The valley extends from San Pablo Bay northward to a point about 2 miles south of the town of Kenwood where the alluvial plain terminates (Kunkel and Upson, 1960).

The principal stream draining the basin is Sonoma Creek. Sonoma Creek is tidally influenced from Schellville downstream to its mouth at San Pablo Bay. Annual precipitation for the Sonoma Valley sub-basin ranges from less than 28 inches in the south to more than 40 inches in the north (USDA, 1999).

Hydrogeologic Information

Water Bearing Formations

The Sonoma Valley groundwater sub-basin is comprised of late Tertiary to Quaternary age volcanic rocks and continental sedimentary deposits. The water bearing units within this sub-basin include the Sonoma Volcanics, Glen Ellen formation, Huichica formation, older alluvium, and younger alluvium. The older and younger alluvium constitute the primary aquifers. However, significant quantities of water can be pumped from the Sonoma Volcanics. The Huichica and Glen Ellen typically have low yields, often sufficient only for limited domestic needs (Kunkel and Upson, 1960).

Younger Alluvium. The younger alluvium is of late Pleistocene to Recent age (Kunkel and Upson, 1960). It consists of interbedded deposits of unconsolidated gravel, sand, silt, clay and peat. The younger alluvium underlies the stream channels, flood plain deposits, and salt marsh deposits along Sonoma Creek and is generally less than a mile wide. Recent alluvial fan deposits are small and confined to the lower reaches of tributary streams along Sonoma Creek. The younger alluvium overlies all other formations of the Sonoma Valley (Kunkel and Upson, 1960). The younger alluvium is generally unconfined and is usually less than 30 feet thick. The specific yield for this formation ranges from 3- 15

% (DWR, 1982). The high percentage of sand and gravel in the composition enables the younger alluvium to yield water freely. However, the thickness of the deposit is usually insufficient for large well yields (Kunkel and Upson, 1960).

Older Alluvium. The older alluvium is of late Pleistocene age. It consists of unconsolidated, poorly sorted clay, silt, sand, and gravel. It generally overlies the Glen Ellen and Huichica formations and underlies the younger alluvium. The older alluvium is composed of stream channel and alluvial fan deposits. It is exposed on most of the alluvial plain except on the flood channel deposits adjacent to Sonoma Creek and where overlain by the younger alluvium. The older alluvium has a maximum thickness of 500 feet. Most wells are less than 200 feet in depth and intersect lenses of gravel or clay and gravel. Water in the older alluvium is unconfined to semi-confined. Specific yields range from 8-17 % (DWR, 1982). Well yields range to 400 gpm, but yields in excess of 50gpm are rare. Wells to depths of 100 feet or more generally yield enough water for domestic purposes. The outcrop area of the older alluvium is well suited for development and a large number of wells have been drilled, making this one of the chief sources of water in the Sonoma Valley (Kunkel and Upson, 1960).

Pleistocene Huichica Formation. The Huichica formation is of Pleistocene age and composed of deformed continental beds consisting primarily of yellow silt, with some interbedded lenses of silt and gravel or silt and boulders. The Huichica rests unconformably on the Sonoma Volcanics and underlies the older and younger alluvium. It is typically poorly sorted, lenticular, and somewhat crossbedded. It is fine grained except at the very bottom. The total thickness of this formation is estimated to be at least 900 feet. The permeability of the Huichica formation is low and generally yields insufficient water even for domestic purposes (Kunkel and Upson, 1960).

Pliocene-Pleistocene Glen Ellen Formation. The Glen Ellen formation is of Pliocene to Pleistocene age. It surfaces only in the northwestern portion of the Sonoma Valley. It unconformably underlies the younger and older alluvium and likely is in contact with the Huichica formation. The Glen Ellen formation is composed mainly of alluvial fan material deposited in a subsiding basin near the Sonoma Volcanics terrane. It consists of poorly sorted lenticular beds of clay, silt, sand, and gravel. The Glen Ellen formation is perhaps equivalent to the Huichica formation. The uppermost Sonoma Volcanics appear to interbed with the Glen Ellen formation. The total thickness of this formation is unknown (Kunkel and Upson, 1960). Water within this formation is confined to semi-confined. Specific yields range from 3-7 % (DWR, 1982). Permeability is low in the Glen Ellen formation and yields from wells

are usually adequate only for limited domestic needs.

Pliocene Sonoma Volcanics. The Sonoma Volcanics constitute a thick highly variable series of continental volcanic rocks, including andesite, basalt, and minor rhyolite flows with interbedded coarse to fine grained pyroclastic tuff and breccia, redeposited tuff and pumice, and diatomaceous mud, silt, and sand. There is also a distinctive body of rhyolite flows and tuff with some obsidian and perlitic glass (Kunkel and Upson, 1960). Specific Yields vary from 0-15% (DWR, 1982). The Sonoma Volcanics is believed to have been formed in the interval between late Miocene and early Pleistocene times. The Sonoma Volcanics is composed of three units, the St. Helena rhyolite member, the Diatomaceous member, and an undifferentiated unit, each several hundred feet thick:

(1) The basal undifferentiated volcanic unit is composed of tuff, pumice, breccia, and agglomerate with interbedded flows of andesite and basalt. Wells within the basal unit derive water principally from the pumice and tuffs. The tuff beds are locally confined to semi-confined. Yields for wells within this unit are moderate, proportional to the thickness of the tuff penetrated below the water table (Kunkel and Upson, 1960).

(2) The Diatomaceous member, near the middle of the formation, is composed of fine-grained diatomaceous clay and diatomaceous tuff. The diatomaceous deposits are generally of low yield. The water is of poor quality and is reported to have high iron and sulfur concentrations (Kunkel and Upson, 1960).

(3) The St. Helena rhyolite member rests unconformably on the other two members of the Sonoma Volcanics. It is composed of banded rhyolitic flows, welded rhyolitic tuff, with some obsidian and perlitic glass. Permeability is very low and few wells are drilled in this member (Kunkel and Upson, 1960).

Recharge Areas

Natural recharge predominantly occurs where stream channels cut into the alluvial fan deposits. Areas of low relief and sufficiently permeable soil, within the watershed, also allow for some slow infiltration from precipitation.

Groundwater Level Trends

Groundwater levels have fluctuated over the period of record but are presently at relatively high

levels. One well near the city of Sonoma recovered to historic high levels after the Sonoma County Water Agency began importing surface water from the Russian River in 1965. Ground water levels in monitored wells normally fluctuate10 feet between spring and fall. Hydrographs generally indicate that ground water levels have remained steady since1965, with the exception of the 1976-1977 drought, during which time water levels dropped an average of 7 feet below the normal yearly low, recovering by spring 1978 (DWR, 1982).

Luhdorff & Scalmanini Consulting Engineers (1999) report that two isolated areas in the Sonoma Valley (of eight general areas with available data) indicate substantial declines in groundwater elevations. These areas appear to represent localized aquifers with inadequate available groundwater recharge. These two areas are identified in their report as the Fowler Creek and Buena Vista Areas, located to the west and east of Sonoma, respectively (Luhdorff & Scalmanini Consulting Engineers, 1999).

Groundwater Storage

Groundwater Storage Capacity. Groundwater storage capacity has been addressed in two separate studies in the Sonoma Valley sub-basin. Storage to a depth of 200 feet was estimated by the USGS to be 180,000 acre-feet (Kunkel and Upson, 1960). This estimate is based on study area approximately 22,400 acres in extent. Area within the Sonoma Valley, underlain by the younger and older alluvium, and generally south of state highway 121 near Schellville was excluded. In this area all deposits to a depth of 200 feet contain salty water and have no usable storage capacity as defined by this study (Kunkel and Upson, 1960).

In California Department of Water Resources, Bulletin 118-4, *Evaluation of Ground Water Resources Sonoma County* published February 1982 the total storage capacity was reported to be 708,000 acre-feet. The Sonoma Volcanics were not included in this estimate due to their highly variable yield. This estimate was based on a study area including 103,000 acres. The current definition of the Sonoma Valley sub-basin by the DWR has resulted in portions of this study area being allocated to the Napa Sonoma Volcanic Highlands groundwater basin and to the Kenwood Valley groundwater basin (DWR, 1982). As presently defined the Sonoma Valley groundwater basin contains 44,650 acres. Consequently, the total storage capacity of this sub-basin is less than this previous estimate.

Groundwater in Storage. Total groundwater in storage was estimated to be 559,000 acre-feet in

DWR's Bulletin 118-4. As noted in the section on total storage capacity the re-definition of the Sonoma Valley groundwater basin has reduced its areal extent and this will result in a reduction in the volume of groundwater in storage (DWR, 1982).

Groundwater Quality

Characterization. Water of the Sonoma Valley sub-basin is generally good for most purposes. Sodium bicarbonate and sodium chloride are the most frequently occurring types of water. Water of better quality is generally obtained from the alluvium than from other formations (DWR, 1964).

Impairments. Brackish water occurs in deposits near San Pablo Bay and along the tidal portions of Sonoma creek. The Sonoma Volcanics frequently contain water that is highly mineralized (DWR, 1982). The Regional Water Quality Control Board reports that 43 underground fuel tank leaks have occurred in the Sonoma Valley (Luhdorff & Scalmanini, 1999).

Groundwater Budget (Type C)

DWR Bulletin 118-4 estimated the average annual recharge to the Sonoma Valley groundwater basin to be 22,000 acre-feet. Groundwater pumpage was estimated to be 6,000 acre-feet in 1980 (DWR, 1982). Recall that the study area for the 1982 report is substantially larger than the area of the Sonoma Valley groundwater sub-basin as presently defined. Insufficient data is available to develop a more precise groundwater basin water budget at this time.

Well Production Characteristics

Well Yields: (gal/min)	Municipal/Irrigation: Range: 20 – 1000 Average:
Production Depths: (ft)	Total depths of completed wells Domestic: Range: 30 - 1100 Average: 274 (based on 73 wells) Municipal/Irrigation: Range: 250 - 1140 Average: 516 (based on 8 wells)

Active Monitoring Data

Agency	Parameter	Number of Wells /Measurement Frequency
DWR Valley of the Moon Water District	Groundwater levels	10 wells semi-annually, 2 monthly 6 wells variable
	Miscellaneous water quality	
Department of Health Services and cooperators	Title 22 water quality	36 wells

Basin Management

Groundwater Management:	
Water Agencies: Public	Sonoma County Water Agency City of Sonoma Valley of the Moon Water District
Private	

References Cited

California Department of Water Resources. *Evaluation of Ground Water Resources, Sonoma County Volume 4: Sonoma Valley,* Bulletin 118-4, February 1982

California Department of Water Resources. *Quality of Ground Waters in California1960, Part 1 Northern and Central California,* Bulletin 66-60, 1960

Kunkel, Fred and J.E, Upson. *Geology and Ground Water in the Napa and Sonoma Valleys, Napa and Sonoma Counties, California.* US Geological Survey Water Supply Paper 1495, 1960

Luhdorff & Scalmanini Consulting Engineers. *Master Plan for Groundwater Development and Management, valley of the Moon Water District*, April 1999

USDA. *United States Average Annual Precipitation, 1961-1990: Map Layer,* 1999

Additional References